TYPHUS FEVER IN GREEK REFUGEES

BY

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During the last six months my duties in Greece have brought me into contact with about one thousand two hundred cases of typhus fever. From the nature of my work I saw the disease mainly from the standpoints of the medical administrator and the sanitary officer endeavouring to stamp it out in the areas allotted to the British Red Cross Society.

Epidemiology. The Greek refugees primarily brought the disease with them from Asia Minor and the Near East. With us the epidemic began at the end of January, 1923, gradually rose in number and severity of attacks, reached a maximum about the first fortnight in March, remained stationary a month or so and is now (June 22nd) dying out.

It is noteworthy that in the areas in which the refugees have been widely dispersed on the land there has been no typhus, or it has not gained a foothold when introduced. The brunt of the epidemic has been borne by the larger and medium-sized towns, the smaller either escaping, or being only slightly invaded. The city of Athens and its environs, Salonica, Patras, Corfu, and many other large towns, have suffered severely from the disease, whereas whole rural districts in Macedonia and Western Thrace have not been affected at all.

The housing conditions of the refugees, the hardships they have experienced, especially the insufficient food and exposure, have considerably reduced their stamina and vitality, and lowered their resistance to disease.

The outbreak attained its maximum of intensity in the mid-winter. In the colder weather the people are more crowded together, they wear thicker clothes which foster lice, and they bathe less frequently. Throughout the winter the refugees were packed with the ordinary civil population in the waiting-rooms of railway stations

and in other places; contact causes were therefore more frequent. In some small towns the number of refugees alone is equal to the former population; in others the refugees out-number the permanent inhabitants by two, or even three, to one. In the Landgada Valley (near Salonica) overcrowding has reached its possible limits. The ordinary population of the village of Landgada is five hundred; during the last six months one thousand six hundred refugees have been added to it. In one small refugee room, 9 ft. by 13 ft. as regards floor space and 5 ft. 6 ins. to the roof, I found four adult women and four children from 7 to 13 years old living; all the husbands were prisoners with the Turks; this was one of many similar overcrowded rooms above cowsheds. One could multiply instances of this sort; but overcrowding is only one of the many economic factors that enter into the epidemiology of typhus.

What has been happening is that infected refugees are necessarily brought into intimate contact with their non-infected comrades, all of whom were at one time (and to some extent are still) lice ridden. Infected lice are transferred to uninfected refugees. In the overcrowding that has arisen in nearly all the larger towns of Southern Greece, lousy infected refugees have also been brought into contact with the people of the permanent community, and the disease has thus spread to them. On several occasions I have seen, in organised refugee camps, typhus fever cases living with the uninfected and sharing the common bed, which is practically always the floor of the room or block they inhabit. The same takes place in railway stations where verminous typhus refugees infect the ordinary passengers in the waiting-rooms. Other hardships exist. A very large percentage of the refugees get only a bare subsistance allowance of food. There are districts in which the men who can work get no food dole and the out-of-work women only about six to eight ounces of bread or flour a day. For some months few refugees had a change of clothing; undergarments were especially scarce. With only one suit of clothes the practical difficulties of delousing are obvious; it is put through the steam disinfector and dried while the refugee is having his bath. It is necessary to emphasise that the sanitary condition under which the refugees lived for months after their coming to Greece was very bad; it has been greatly ameliorated.

Mode of Transmission. The transmission of typhus by body and clothes lice may be accepted as proved; the infected human louse is the intermediary in the transmission of typhus from typhus cases to the healthy—ordinarily there is no direct communication of the disease from man to man. If it were possible to exterminate human lice in an infected area, the disease would cease. Further, if we could rid all typhus cases of lice the disease would come to an end. All our radical preventive measures are based on these facts. Somehow it has got abroad that it is only the body-louse that acts as a carrier. This is not the case; the exculpation of *P. capitis* is a dangerous and pernicious theory to inculcate.

Period of Incubation. A generation or so ago, twelve days used to be given as the period of incubation. All recent experience of the disease in Russia and Greece shows this to be correct. It has been proved by the inoculation of human blood experimentally; inoculation of monkeys with infective human blood has likewise demonstrated it.

Most cases are admitted into infectious diseases hospitals on the fifth day of the disease, the next most frequent is the sixth day. This late admission arises from several causes—antipathy of the refugees to typhus hospitals, their ignorance as regards the nature of the disease, inability to obtain medical advice, overwork of the doctors, etc. In all but a very small proportion of cases the eruption is out by the time the patients reach the hospital.

Symptoms. In the vast majority of cases there are prodromata in the form of ill-defined malaise with vague symptoms for two or three or even four days before more severe indications arise. The real onset is well-defined. In typical cases the patient knows the day, often the hour, when he first felt genuinely ill and had to go to bed. The face is then somewhat flushed, the conjunctiva injected, the expression excited or dull, the tongue is coated, the lips and mouth dryer than normal; thirst, constipation, severe headache, pain in the back and limbs are complained of. Constipation is present in the great majority of cases, and often persists throughout the illness. By the time the patient is brought to hospital (fifth or sixth day) there is as a rule no doubt about the diagnosis. By the fifth day the mucous membranes are often implicated in the rash. The tongue has a well-marked white coat and is tending to become dry;

later the tongue is fissured, the mouth becomes offensive, sordes collect on the teeth, although these latter conditions can in many cases be prevented by proper nursing. Diarrhoea is not common in the early stage; about 20 per cent. of the cases develop it in the later stages. Asthenia and muscular debility are always present; patients can scarcely move in bed, they are often unable to protrude the tongue, and lose all expression. Emaciation in some cases towards the end of the disease is marked. In a small proportion of cases there is a definite crisis; in most cases, however, there is lysis, but a mixture of these beginning with lysis and ending in a crisis or the reverse may take place. The most common symptom of the real onset is headache, usually frontal, but sometimes mainly occipital. Conjunctival injection is present in four-fifths of the cases; it increases with the development of the eruption until lysis begins. Vomiting is present in about 25 per cent. of the cases. Sometimes it is severe and persisting for several days.

In many cases there is a distinctly reddish blush along the edge of the soft palate and pillars of the fauces, less frequently also slight congestion of the throat.

The Temperature. Whilst I believe it is possible to construct and describe what might be considered a normal temperature chart for an average case of moderately severe typhus, it is seldom that such a chart is met with in the wards in the natural course of the disease. A continuous or slightly remittent temperature of 103° or 103·5° F., during the first half of the second week, and then a slight daily decline until the eleventh or twelfth day, when there is a more decided remission with abatement of all the symptoms, is ordinarily what may be expected. Then there is another rise, say on the twelfth day, and a remission, and a second similar oscillation though less marked, with a decline to normal, and even a third, the whole lysis occupying forty-eight to sixty or seventy-two hours. Irregular temperatures are also met with. Again a definite crisis with a fall of temperature to normal in twenty-four or thirty-six hours may occur, although this is exceptional. After the temperature has dropped and the symptoms have disappeared, the drop may be to sub-normal for some days.

Of two hundred and forty-six cases that recovered, in nineteen the temperature was normal on the twelfth day, thirty-seven on the

thirteenth day, sixty-six on the fourteenth day, forty on the fifteenth day, and twenty-two on the sixteenth day.

The Pulse. Normally in ordinary cases, the pulse-curve follows that of the temperature. The pulse, however, is liable to show much variation; sometimes marked oscillations occur in the twenty-four hours, being at one time ninety and at another one hundred and twenty to one hundred and thirty in a minute. Dicrotism is not uncommon, especially towards the end of the second week. With the tendency to cyanosis so commonly seen in the late stage of the second week, the pulse is often absent at the wrist. The state of the patient's lungs appear to me greatly to affect the pulse, especially in wide-spread broncho-pneumonia. The pulse is markedly improved on the first signs of defervescence; in a few a very slow pulse is present in convalescence. The respiration curve varies less than that of the pulse.

The Respirations. In uncomplicated cases with moderate temperatures, the respirations are shallow and from thirty to thirty-five per minute, they vary little and without real dyspnoea at any stage. In similar cases with broncho-pneumonia, dyspnoea becomes a serious symptom.

The Eruption. This first appears on the evening of the fourth day in the form of discrete and well-defined pink or roseolar spots which may be round, oval or irregular, varying from 2 to 5 mm. in diameter, vanishing on pressure; they are seldom palpable at this stage, but they are widespread though scanty, and are seen on the abdomen, back, chest, shoulders, arms, legs and feet; they are rare on the face and head. In this early stage the rash described is not very obvious, it may require careful scrutiny to find it. The macules then become larger and of a bright red colour, next assuming a purplish-red hue running into dark purple. At this stage the tendency is for the eruption not to disappear on pressure, but this is not invariable—in many cases ending fatally with a deep coloured eruption before death, no sign of it remains *post-mortem.* When the eruption is fully developed on the eighth or ninth day, well-defined dark coloured patechial areas which do not disappear on pressure are seen, besides less-defined patches of much lighter colour which do not disappear on pressure. In all severe cases with typical eruption, these erythematous and patechial patches are met with

during the second week of the disease. In blonde boys and girls, during the early stage of the disease, we sometimes see on the chest, neck, arms, and occasionally on the abdomen, an irregular or blotchy erythema which vanishes before the real eruption is developed. In the second week the eruption has a multiform character—roseolar patches, red spots, maculae, small patechiae and large plaques typically patechial are seen; this multiformity is well seen on the shoulders and back, lower part of the abdomen and hips, outer surface of the arms and forearms, on which places what has been admirably named 'subcuticular mottling' is also visible. The eruption may, however, vary from consisting of only faint roseolar slightly raised spots to large ecchymotic looking patches. By the end of the second week little of the eruption is left. In some cases the general lousiness antecedent to the onset of the disease leads to considerable skin irritation with scratching and local secondary infections, which may initially be rather puzzling. Chronic pediculosis and pityriasis versicolor (both common in refugees) are the chief conditions of the skin likely to lead to confusion in a diagnosis based on the eruption alone. In about 1 per cent. of typhus cases there is either no eruption or only a faint roseolar one; this is more frequently the case in children and adolescents; in these cases the Wiel-Felix reaction is present. It is useful to carry about a good hand-lens, and, to bring out the eruption, rub into the skin some petrolatum; the lesions are then seen to consist of a congeries of dark red blood vessels.

Insomnia is one of the commonest symptoms; the majority of cases suffer from it during the first week of the disease.

In about 25 per cent. of the cases some form of mental disturbance is present on admission, and on the seventh or eighth day delirium. In cases that are running a fatal course, the delirium often passes into coma more or less complete. Cough is one of the most constant symptoms. In the earlier stage it is short and dry. Later on the expectoration may become profuse and mucopurulent. In a number of cases patches of lobular pneumonia occur. This is a common terminal condition in fatal cases. Diarrhoea is common in the later stages of the disease, and is then sometimes associated with rectal incontinence. Parotitis is one of the more serious complications; I saw altogether twenty of these cases, and as many as three in a

ward of thirty patients. Otitis media occurs in a small percentage of cases; it may become chronic. Deafness is a marked feature in many cases of typhus, during the late stage of the disease; this is quite distinct from the dullness of intellect that exists during that stage.

The spleen can be felt in about two-fifths of the cases; sometimes it is of considerable size. I do not lay stress on this, as many patients have a history of old malarial infection.

In all hospitals dozens of recurrent fever were sent in as typhus. In relapsing fever the *sudden* onset with rapid rise of temperature, severe headache, pains in the back and extremities, absence of dulness and apathy and (ordinarily) of rash, the presence of a moist tongue and of *S. obermeieri* in the blood, and later in the disease, more or less anaemia, should be sufficiently distinctive. In the Salonica Hospital the records show that eight cases of typhus and relapsing fever ran their course concurrently in the same persons.

The use of neo-salvarsan for the recurrent fever did not affect the normal progress of the typhus. The combined infection seems to suggest that the same louse may be able to carry the virus of typhus and *S. obermeieri* and inoculate them at the same time. Of course, two or more lice, each with a single infection, may have attacked these cases. It seems to be established that, contrary to the rule with intermediate hosts, the virus of typhus eventually kills the louse. In many, typhus and influenza ran together, the latter disease being also epidemic at the time. Hundreds of cases of both smallpox and typhus have been admitted into infectious diseases hospitals; in no single instance have both diseases been met with in the same patient at the same time; in one, typhus followed smallpox from infection acquired in the hospital.

Wiel-Felix Reaction. In typhus this reaction is very distinctive. It owes its origin to the discovery of the fact that what are called the 'X' strains of *B. proteus* are agglutinated by the serum of typhus cases. The special strains that do this are X2 and X19; these were primarily obtained from typhus urine. The macroscopic method is here usually adopted. The minimum dilution accepted as positive is 1 to 100. Practically the serum of every typhus fever case after the eighth day is positive, whilst that of other fevers is negative.

Complications. Bronchitis of greater or lesser severity is present in a large proportion of cases. Broncho-pneumonia is another common complication affecting the bases of both lungs. Pleurisy is much less frequent. Other complications are—severe diarrhoea, myocarditis, cardiac dilatation, parotitis, otitis media, conjunctivitis, keratitis, gangrene of the toes, bedsores, etc.

Prophylaxis. Medical men, nurses, and all sick attendants looking after typhus cases should be thoroughly protected from lice by suitable white cotton or linen clothing from head to foot before commencing their work, and have a bath and complete change of clothing after finishing their day's work. Even with these precautions infections will occur, but without them infection is all but certain, sooner or later, in those not immunised artificially, or by a previous attack of the disease.

Etiology. It would appear that the micro-organism of typhus passes through a development stage in the louse; in that insect it is intracellular, develops, is set free and is introduced into man. In man it is said to become intracellular once more, and from the infected cell to be thrown into the blood with its toxins. The members of the Typhus Fever Commission of the League of the Red Cross Societies to Poland, however, found no evidence of the development of the micro-organism in the louse, but they arrived at certain important conclusions as the result of their work.

Summarised, their conclusions are:—

Pathology. The lesions of typhus appear to be situated in the blood vessels of the skin, central nervous system, skeletal muscles, and to a lesser extent in some of the viscera—heart, kidney and testes. Typhus is considered to be a disease of the smaller blood vessels, and localises almost exclusively in the vascular endothelium. The reaction to the parasite is shown primarily by degenerative changes giving rise to thrombi in the blood-vessels, and by a proliferative reaction on the part of the endothelium and neuroglia which give rise to the characteristic 'nodules' of the disease in the skin and central nervous system. When lice are fed on typhus cases, while they develop *Rickettsia prawazeki* with great regularity they develop no other form of micro-organism. All lice so far do not become infective, but why this is so is not determined. Infection with *R. prawazeki* eventually kills the louse, which is an exceptional

effect of a parasite upon its intermediate host. *R. prawazeki* escapes from the alimentary tract with the faeces, and therefore may be introduced by scratching or by the mouth-parts of the louse becoming soiled with the faeces. *Rickettsia* has not been found in the salivary glands or in the mouth-parts of the louse.

Mortality. The average mortality in the infectious diseases hospitals near Athens is roughly 10 per cent.; it is, however, higher in some towns, such as Corfu, Patras, Volo, etc. It varies also greatly at different ages. In refugees of 50 years and over, the death rate is high, reaching in some towns 50 per cent.

It is necessary that some definite routine plan should be adopted in admitting typhus fever cases into hospital and distributing them in wards. The first requirement is a receiving-room, to which all patients are primarily brought. Here the hair of the head is rapidly cut off with a machine clipper, the hair of the axillae and pubes being shaved off; the hair is to be burnt. The receiving-room should communicate with the room or other area containing the steam-disinfector on the one hand, and with the bathroom on the other; this latter should lead to the dressing-room. After removal of the hair the patient is put on a stretcher and conveyed to the room containing the disinfector. Here he discards everything that he brings with him, which is disinfected. He is taken to the bathroom and bathed. He is then put on a clean stretcher and removed to the dressing-room; here he receives a suit of clean hospital clothing and is taken to the ward he is to occupy. There must be no remission in this routine; it must be thoroughly carried out if the wards are to be kept free from infected lice. Nothing that the patient brings with him to hospital should enter the ward.

Thoroughly deloused typhus cases are perfectly innocuous to the uninfected, and if we are quite confident as regards the efficiency of our delousing arrangements there is no reason for putting them in different wards.

Treatment. Typhus patients should be kept in bed throughout the pyrexial stage of the disease, and for a fortnight after the fever has subsided. Constipation is best relieved by a simple enema every second day. In some cases the catheter has to be used to drain off the urine. In the early stage, when sleeplessness, irritability, general discomfort and delirium are present, small doses of morphine

give satisfactory results. The morphine may later on be replaced by veronal, sulphonal, paraldehyde or chloral hydrate, if one or other is called for in mild delirium or insomnia. For prolonged and marked active delirium, hyoscine, hypodermically, is a valuable drug. The most popular stimulant is hypodermic injections of camphor (5 grains in 1 c.c. of olive oil or ether put up in ampoules); strychnine is also largely employed.

Prophylactic Inoculations. As a substitute for a prophylactic vaccine the blood of typhus fever cases has been inoculated, and the virus thus introduced in a living state. In using the living virus, Kusama injected monkeys with a fairly definite minimum dose of typhus blood, known as the minimal morbid dose, to bring about an attack. If a smaller dose is given no attack occurs, but a state of immunity is produced and the animal can tolerate many times the minimal morbid dose without ill-effects. This active form has so far not been used; the killed virus is the one that is used here. Whether it has any prophylactic value is uncertain.

Prevention. The amount of actual physical labour connected with the preventive work associated with typhus may be understood by describing what took place in two large blocks housing nearly two thousand refugees, in March last. From the 12th to the 17th, the whole camp was deloused and all bedding and clothing put through the steam disinfectors. The entire floors were washed with disinfectants and the walls whitewashed. This meant that every room had to be emptied of its entire contents while this was going on; then all the belongings of the refugees returned to the cleaned rooms, which were shut off from those awaiting their turn. It likewise meant giving a complete hot bath to everyone in the camp under supervision. From the 19th to the 24th there was a renewal of the bathing. A slight recrudescence of typhus after this necessitated a repetition of the processes carried out previously. This was done from the 26th to the 31st March. All men's and boys' heads were shaved, and all girls up to the age of fourteen had their hair bobbed. All cases of actual typhus, of course, had their heads shaved. Our nursing sisters also used on the heads of the refugees in camp the mixture of equal parts of kerosene and olive oil we employ to free nits from hair, and they distributed N.C.1 powder (naphthaline ninety-six parts, creosote two parts, iodoform two parts)

which was in little bags to be worn for a week, when a fresh bag is issued. The idea is that the heat of the body helps to vaporize the ingredients, and in this way is created a louse-destroying atmosphere next the skin and the clothes.

By order of the Government, refugees are allowed to leave the camps to work or to search for work, so long as their identity cards show that they are free from infectivity, which means free from lice. Many of the people allowed outside run the risk of acquiring the disease in other refugee camps which they visit, or elsewhere. This at present is unavoidable. Another weak link in the chain of preventive measures was the fact that for months after their arrival in Greece, a large percentage of the refugees did not possess a change of underclothes. It is obvious that where the people have only one suit of clothing there must be grave difficulties in rendering them lice free. An adequate supply of steam disinfectors for delousing clothes and bedding is almost indispensable; in their absence the task is most laborious. In small communities, Serbian barrels and other such improvisations may be useful, but in dealing with large masses of people they are futile.

I believe it to be well worth while in every camp to endeavour to educate the people in regard to the nature of typhus and the principles that underlie its eradication and prevention. We placarded leaflets in this connection, and also had them read out periodically for the benefit of the illiterate.

The specific measures now indicated appear to be to disperse the refugees from overcrowded towns to rural areas as much as possible. Another urgent requirement in many towns is an increased supply of water, which should be available to every house, or at least be within easy reach. In some camps the water-supply is decidedly defective, which interferes with the bathing arrangements, steam-disinfection of clothing and bedding and ordinary laundry-work—serious obstacles when endeavouring to eradicate typhus fever from an infected camp. The Greek Administration is endeavouring in all possible ways to remove this difficulty.

Every effort to quarantine contacts has failed, and all things considered it is not reasonable to expect it. All we want is that the person who is a contact should be watched definitely for twenty-one days, that is the time we laid down as the incubating

period. We endeavoured, as far as was possible, to render these certificated people free from lice; we felt that if thus free they could not communicate typhus, even if they acquired it themselves in the meantime. The quarantining of contacts in a small country which contains over a million refugees, many thousands of whom are contacts and are either in search of work or have daily to go to work from their camps and return to them, is an impossibility. It may be easy to do this in a limited area of infection with a stationary and disciplined population; it is an impossibility among refugees. The hope is that nature will step in during the summer and bring the epidemic to an end by stopping the multiplication of lice, by unfavourable meteorological conditions, and that by the beginning of the next typhus season the economic and other conditions will have altered for the better. At the present moment it is certain that the economic state of the refugees is decidedly antagonistic to effecting a cessation of the disease by the adoption of ordinary preventive measures.

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